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H04Q 7/22**H04Q 7/28****H04Q 7/34**(21) Application number: **08045946**(71) Applicant: **FUJITSU LTD**(22) Date of filing: **04.03.96**(72) Inventor: **TAKAGI TADASHI**(54) **TRANSMISSION LINE SELECTOR FOR MOBILE COMMUNICATION SYSTEM**

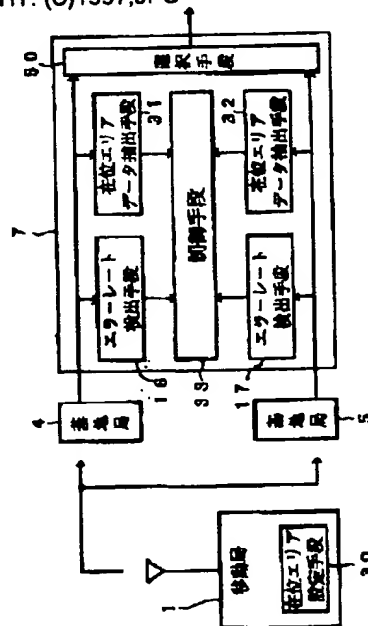
(57) Abstract:

PROBLEM TO BE SOLVED: To attain automatic selection of a transmission line capable of optimum communication by allowing a mobile station to add prescribed area data and sending the resulting data to a base station so as to improve the selection precision of the transmission line.

SOLUTION: A setting means 30 of a mobile station 1 sets position area data specified by crossing position of latitude and longitude and adds the data to communication data and sends the resulting data as a radio wave. A communication station 7 uses detection means 16, 17 to detect a signal error rate from base stations 4, 5 from a demodulated reception signal and gives the result to the error rate recognition section of a control means 33 and compares both the error rates to select automatically the optimum transmission path. When the error rate of each transmission line is identical or the error rate is lower than a prescribed value, position area data extract means 31, 32 use a selection means 50 to select a path via the base station 4 or 5 closest to the position area. Thus, selection precision of the transmission line via plural base

stations is improved and a transmission line capable of optimum communication with the mobile station is selected.

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[Name of Document] SPECIFICATION

[Title of the Invention]

TRANSMISSION LINE SELECTING APPARATUS IN MOBILE COMMUNICATION
SYSTEM

[Abstract]

[Problem]

It is an object of the present invention to provide a transmission line selecting apparatus in the mobile communication system that can select a transmission line for enabling the optimum communication with the mobile station among the transmission lines that pass a plurality of ground stations to which the communication station is connected by cable.

[Solving Means]

The transmission line selecting apparatus 6 comprises a mobile station 1 which includes a present setting area means 30 for setting the present area data (D1) showing the present area defined by the longitude/latitude intersecting position, and a communication station 7 which includes a plurality of error rate detection means 16, 17 for detecting the error rate (ER) of the receiving data from the mobile station 1 via a plurality of ground stations 4, 5, extraction means 31, 32 for extracting D1 of mobile station 1 in receiving the data and ground stations 4, 5, a control means 33 for recognizing an output ground station 4 of the receiving data of the minimum

detected ER, recognizing the ground stations 4, 5 installed at the present area nearest to the present area of the mobile station 1 from each D1 extracted, and controlling the selection of the transmission line that passes either of recognized ground station 4, and a selection means 50 for selecting a transmission line in compliance with the control of the control means 33.

[Scope of Claim for a Patent]

[Claim 1]

A transmission line selecting apparatus in mobile communication system for selecting the transmission line for carrying out optimum communication with a mobile station among transmission lines that pass a plurality of ground stations to which communication stations are connected by cable comprising:

- the mobile station which includes a the present setting area means for setting the present area data showing the present area defined by the longitude/latitude intersecting position, and

- the communication station which includes a plurality of error rate detection means for detecting the error rate of the receiving data from the mobile station via a plurality of ground stations, a plurality of present area data extraction means for extracting the present area data of the mobile station and that of a plurality of ground stations in receiving data, a control means for recognizing an output ground station of the receiving data of minimum error rate detected by the plurality of error rate detection means, at the same time recognizing the ground station installed at the present area nearest to the present

area of the mobile station by the present area data extracted by the plurality of present area data extraction means, and controlling the selection of the transmission line that passes either of the recognized ground stations, and a selection means for selecting a transmission line in compliance with the control of the control means.

[Claim 2]

The transmission line selecting apparatus in the mobile communication system recited in claim 1 characterized in that the setting of the present area data in the present area setting means is automatically carried out in compliance with the ground measuring satellite data of GPS.

[Claim 3]

The transmission line selecting apparatus in the mobile communication system recited in claim 1 characterized in that the setting of the present area data in the present area setting means is manually carried out by the operator.

[Claim 4]

The transmission line selecting apparatus in the mobile communication system recited in any one of claim 1 to 3 characterized in that the control is carried out in such a manner that the ground station located in the present area nearest to the present area of the mobile station by each present area data extracted by the present area data extracting means and the transmission line that passes the recognized ground station is selected when the error rates detected by a plurality of error rate detection means are equal.

[Claim 5]

The transmission line selecting apparatus in the mobile communication system recited in any one of claim 1 to 3 characterized in that the control is carried out in such a manner that the ground station located in the present area nearest to the present area of the mobile station by each present area data extracted by the present area data extracting means and the transmission line that passes the recognized ground station is selected when the error rates detected by a plurality of error rate detection means are smaller than the specified value.

[Detailed Description of the Invention]

[0001]

[Technical Field Pertinent to the Invention]

The present invention relates to a transmission line selecting apparatus in a mobile communication system. The transmission line selecting apparatus selects a transmission line that can properly communicate with a mobile station among the transmission lines that pass a plurality of ground stations when the communication station communicates with a mobile station that passes a plurality of ground stations connected by cable.

[0002]

When this kind of selection is made, the error rates in each transmission line between, for example, the mobile station and a plurality of ground stations are compared and the transmission line with a small error rate is selected, but in such event, improvement of selection accuracy is required.

[0003]

[Prior Art]

FIG. 4 shows a transmission line selecting apparatus in the conventional mobile communication system and the description will be made in detail as follows.

[0004]

In FIG. 4, reference numeral 1 indicates a mobile station that includes a wireless apparatus 2 and data adder 3, reference numerals 4, 5 indicate ground station, and reference numeral 6 indicates a transmission line selecting apparatus installed to a communication station 7 connected by cable to ground stations 4, 5.

[0005]

In the transmission line selecting apparatus 6, reference numerals 8, 9 indicate transmission apparatus, reference numerals 10, 11 indicate data/speech separators, reference numerals 12, 13 indicate data modulation/demodulation sections, reference numerals 14, 15 indicate error correction encoders, reference numerals 16, 17 indicate error rate detectors, reference numeral 18 indicates an error rate comparator, reference numeral 19 indicates a data selector, and reference numeral 20 indicates an voice signal selector.

[0006]

The data adder 3 of the mobile station 1 processes the ATIS signal that indicates the transmitter, AVM dynamic transmission signal (vehicle dynamic notification signal), and SELE call signals that carry out communication start setting and data

transmission start setting.

[0007]

When the communication station 7 carries out communication via a mobile station 1 with these functions and a plurality of ground stations 4, 5, a transmission line that carries out optimum communication with the mobile station 1 is chosen by the transmission line selecting apparatus 6.

[0008]

First of all, the transmission apparatus 8, 9 of the transmission line selecting apparatus 6 receives radio signals which the mobile station 1 transmits by prepositioning the code string with ATIS signal, AVM dynamic signal, or digital SELE call signal error-encoded in front of the voice signal via a plurality of ground stations 4, 5.

[0009]

This receiving signal is separated to the data and voice signal at the data/voice separators 10, 11. The separated voice signal is outputted to the voice signal selector 20. The data is demodulated at the data modulation/demodulation sections 12, 13, and after error-correction encoding process is carried out at the error correction encoders 14, 15, the data is outputted to the error rate detectors 16, 17.

[0010]

After the error rate of the encoded data is detected at the error rate detectors 16, 17, both error rates are compared at the error rate comparator 18. And the data with better error rate is recognized, and the selection control signal for

selecting the transmission data and voice signal from the ground station which receives the recognized data is transmitted to the data selector 19 and the voice signal selector 20.

[0011]

By this, the transmission line that carries out the optimum communication with the mobile station 1 is selected. That is, by detecting the best value of the code error ratio of the received signal, the best transmission line through which the mobile station 1 replies is automatically selected.

[0012]

For other automatic transmission line selecting system, there is an electric field comparing system or S/N comparing system for installing in the ground station a detector of receiving electric field of S/N and an adder for transmitting the data to the communication station, and comparing the electric field information from each ground station and selecting the transmission line based on the comparison results for the communication station. This system has a feature to carry out highly accurate transmission line selection by optimizing the integration time of electric field or S/N but cannot configure a system with the adder of the communication station alone.

[0013]

[Problem to be Solved by the Invention]

In the conventional transmission line selecting apparatus 6 discussed above, for the data signal, a demodulation method or signal type that is difficult to generate data error is

essentially used, and therefore, if the transmission line selecting apparatus is adopted to the system with a little data transmission amount, the data error does not occur unless the transmission quality such as block S/N, etc. of the transmission line is considerably degraded, and the error rate is unable to be compared at a sufficient accuracy, and there is a problem in that an optimum transmission line cannot be selected.

[0014]

That is, when the error rate is compared between the transmission line with slightly poor transmission quality and the best transmission line and the transmission line is automatically selected, the transmission line is selected in compliance with the priority fixedly set in the adder of the communication station without generating any error in both data of each grounding station, and a symptom of degrading the selection accuracy may occur, in which the best transmission line is not selected and the transmission line with slightly poor line quality is selected.

[0015]

When the transmission line is automatically selected by an error rate comparison method in a system with a little data transmission amount, it is necessary to improve the transmission line selection accuracy by an adder for the mobile station and the communication station only without installing an adder to the ground station such as electric field comparison method or S/N comparison method.

[0016]

When the mobile station is traveling, there is a case in which the transmission line error rate is temporarily degraded in a very small range of the traveling point, and when the transmission line is selected by the error comparison method only by the SELE call signal for communication start setting and communication is made after the transmission line is selected, there is a case in which the selection at the communication start setting is not always optimum because the communication point is moved.

[0017]

The present invention is made in view of these points, and it is an object of the present invention to provide a transmission line selecting apparatus in the mobile communication system that can select a transmission line for enabling the optimum communication with the mobile station among the transmission lines that pass a plurality of ground stations to which the communication station is connected by cable.

[0018]

[Means for Solving the Problems]

FIG. 1 shows a principle drawing of the present invention. The transmission line selecting apparatus 6 shown in this drawing selects a transmission line that carries out the optimum communication with the mobile station 1 among the transmission lines that pass a plurality of ground stations 4, 5 connected to the communication station 7 by cable, and the present invention comprises the mobile station 1 which includes a

present setting area means 30 for setting the present area data showing the present area defined by the longitude/latitude intersecting position, and the communication station 7 which includes a plurality of error rate detection means 16, 17 for detecting the error rate of the receiving data from the mobile station 1 via a plurality of ground stations 4, 5, a plurality of present area data extraction means 31, 32 for extracting the present area data of the mobile station 1 and that of a plurality of ground stations 4, 5 in the receiving data, a control means 33 for recognizing an output ground station (for example, 4) of the receiving data of the minimum error rate detected by the plurality of error rate detection means 16, 17, at the same time recognizing the ground stations 4, 5 installed at the present area nearest to the present area of the mobile station 1 by the present area data extracted by the plurality of present area data extraction means 31, 32, and controlling the selection of the transmission line that passes either of the recognized ground stations 4, 5, and a selection means 50 for selecting a transmission line in compliance with the control of the control means 33.

[0019]

According to this kind of configuration, even when the optimum transmission line is unable to be selected by the comparison because the transmission data amount is small or the error rate is not generated, the optimum transmission line can be selected from the present area data.

[0020]

[Mode for carrying out the Invention]

Referring now to drawings, one embodiment of the present invention will be explained. FIG. 2 is a block configuration diagram of a transmission line selecting apparatus in a mobile communication system according to one embodiment of the present invention. Like elements corresponding to like sections of the conventional example shown in FIG. 4 are given like reference numeral in the embodiment shown in FIG. 2, and their explanation will be omitted.

[0021]

In one embodiment shown in FIG. 2, the elements newly provided are the present area setting section 30 in the mobile station 1, and present area data extracting sections 31, 32 and error rate/present area data recognition control section 33 in the transmission line selecting apparatus 6.

[0022]

The present area means the area surrounded by a plurality of longitude/latitude lines shown by reference numeral 41,42 in FIG. 3. Each of the present areas is recognized by the present area data, and in this example, in the preset area of data "10," the mobile station 1 exists, and in the present area "11," the ground station 4 exists, and in the present area "12," the ground station 5 exists.

[0023]

The present area setting section 30 sets the present area at the current traveling point of the mobile station 1 manually or automatically by the data such as ground measuring satellite

data, etc. of GPS (Global Positioning System).

[0024]

The present area data of the mobile station 1 set is incorporated in the transmission signal by the data adder 3, transmitted to each of the ground stations 4, 5, combined with the present area data of each of ground stations 4, 5, and transmitted to the transmission line selecting apparatus 6.

[0025]

The present area data extracting sections 31, 32 extract the present area data of the mobile station 1 transmitted and the present area data of the ground stations 4, 5 which are known in advance, and outputs them to the error rate/present area data recognition control section 33.

[0026]

The error rate/present area data recognition control section 33 automatically selects the transmission line by the error rate comparison method with the capabilities same as those of the error rate comparator 18 shown in FIG. 4 explained first in the conventional example. If the error rate of each transmission line is same, the transmission line is automatically selected by the present area data.

[0027]

The transmission line of the present area data is automatically selected by recognizing to which of the present area "11" or "12" of ground stations 4, 5, the present area "10" of the current mobile station 1 present in the electric wave zones 43, 44 formed by each of the ground stations 4, 5 of the

present area "11" and "12" shown in FIG. 3 is closer.

[0028]

Under this kind of configuration, the data "10" of the present area where the mobile station 1 exists is set in the present area setting section 30 of the mobile station 1, and when it is modulated to the ATIS or digital SELE call signals in the data adder 3, the present area data previously set is added and is transmitted by electric wave to the ground stations 4, 5 via the radio apparatus 2.

[0029]

This transmission signal is received by the transmitting apparatus 8 and 9 of the transmission line selecting apparatus 6 of the communication station 7 via ground stations 4, 5. This received signal is sent to the present data extracting sections 31, 32 via the data/voice separators 10, 11, data modulation/demodulation sections 12, 13, and error correction encoders 14, 15, and now the present area data "10" of the mobile station 1 and the present area data "11," "12" of the ground stations 4, 5 known in advance are extracted and outputted to the recognition control section 33.

[0030]

On the other hand, the error rate of the receiving signal is outputted to the recognition control section 33 via the error correction encoders 14, 15 and error rate detectors 16, 17. In the recognition control section 33, first of all, the transmission line is automatically selected by the error rate comparison function first explained in the conventional example.

If the error rate of each transmission line is same, the transmission line is automatically selected by the present area data.

[0031]

That is, because the control is made in such a manner that the transmission line that passes the grounding station 4 nearest to the present area "10" of the mobile station 1 is selected, the selection control signal is sent to the data selector 19 and voice signal selector 20. By this, the data selector 19 and the voice signal selector 20 select the data and voice signal sent via the transmission line that passes the ground station 4.

[0032]

If the error rate of each transmission line is smaller than a specified value in comparison of the above-mentioned error rate at the recognition control section 33, the transmission line may be selected by the present area data even if the error rate is not identical.

[0033]

According to the embodiment explained above, as compared to the system in which the transmission line is automatically selected by the error rate comparison method in the system with a little data transmission amount, high accuracy selection of the transmission line is enabled even when the circuit quality is comparatively poor.

[0034]

In addition, as compared to the case in which the

transmission line is selected by the present area notice only, it is possible to provide a recovery function that properly carries out the transmission line selection function by adding the error rate comparison function to the improper setting of erroneous operation entries, etc. and failure of setting at the time of manual entry of present area setting of the mobile station.

[0035]

In the point where the error rate is temporarily degraded, the selection accuracy can be improved by carrying out automatic selection by the present area.

[0036]

[Effect of the Invention]

As described above, according to the present invention, there is an effect of selecting a transmission line that can carry out optimum communication with a mobile station among the transmission lines that pass a plurality of ground stations to which the communication station is connected by cable.

[Brief Description of the Drawings]

[Fig.1]

FIG. 1 is a principle drawing of the present invention;

[Fig.2]

FIG. 2 is a block configuration diagram of the transmission line selection apparatus in the mobile communication system according to one embodiment of the present invention;

[Fig.3]

FIG. 3 is an explanatory drawing of the present area; and
[Fig.4]

FIG. 4 is a block configuration diagram of the
transmission line selection apparatus in the conventional
mobile communication system.

[Description of reference numerals]

- 1. Mobile station
- 4. 5 Ground station
- 6. Transmission line selecting apparatus
- 7. Communication station
- 16, 17. Error rate detection means
- 30. Means for setting present area
- 31, 32. Present area data extraction means
- 33. Control means
- 50. Selection means

FIG. 1

Principle drawing of the present invention

1 MOBILE STATION

30 PRESENT AREA SETTING MEANS

4 GROUND STATION

5 GROUND STATION

7 COMMUNICATION STATION

16 ERROR RATE DETECTION MEANS

31 PRESENT AREA DATA EXTRACTION MEANS

50 SELECTION MEANS

33 CONTROL MEANS

17 ERROR RATE DETECTION MEANS

32 PRESENT AREA DATA EXTRACTION MEANS

FIG. 2

DRAWING OF ONE EMBODIMENT

MOBILE STATION

3 DATA ADDER

2 RADIO APPARATUS

4 GROUND STATION

5 GROUND STATION

GROUND STATION SECTION

6 TRANSMISSION LINE SELECTOR

7 COMMUNICATION STATION

8 TRANSMITTER

9 TRANSMITTER

10 DATA/VOICE SEPARATOR

12 DATA MODULATION/DEMODULATION SECTION
14 ERROR CORRECTION ENCODER
31 PRESENT AREA DATA EXTRACTION SECTION
19 DATA SELECTOR
DATA OUTPUT
SELECTION CONTROL
16 ERROR RATE DETECTOR
17 ERROR RATE DETECTOR
PRESENT AREA DATA
33 ERROR RATE/PRESENT AREA DATA RECOGNITION CONTROL SECTION
PRESENT AREA DATA
11 DATA/VOICE SEPARATOR
13 DATA MODULATION/DEMODULATION SECTION
15 ERROR CORRECTION ENCODER
32 PRESENT AREA DATA EXTRACTION SECTION
20 VOICE SIGNAL SELECTOR
VOICE SIGNAL

FIG. 4

DRAWING OF CONVENTIONAL EXAMPLE

1 MOBILE STATION
3 DATA ADDER
2 RADIO APPARATUS
4 GROUND STATION

5 GROUND STATION

GROUND STATION SECTION

6 TRANSMISSION LINE SELECTOR

7 COMMUNICATION STATION
8 TRANSMITTER
9 TRANSMITTER
10 DATA/VOICE SEPARATOR
12 DATA MODULATION/DEMODULATION SECTION
14 ERROR CORRECTION ENCODER
19 DATA SELECTOR
DATA OUTPUT
SELECTION CONTROL
16 ERROR RATE DETECTOR
17 ERROR RATE DETECTOR
18 ERROR RATE COMPARATOR
11 DATA/VOICE SEPARATOR
13 DATA MODULATION/DEMODULATION SECTION
15 ERROR CORRECTION ENCODER
20 VOICE SIGNAL SELECTOR
VOICE SIGNAL

FIG. 3

EXPLANATORY DRAWING OF PRESENT AREA